Designers, games and players: Same game, different rules?

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ABSTRACT

The overall subject of the paper is single user interaction with computer video games incorporating virtual environments. The paper proposes a three part model of designer, game system and player. A prominent aspect of the relationship between player and video game is seen as a relationship between the embodied individual and a simulated, physical environment designed for interaction. The paper argues that the broad use of the term "rules" is problematic – and in certain cases decidedly counterproductive – and it proposes that we instead consider the term "simulation laws" and embodied interaction with the regularities resulting from this simulation.

Keywords

Embodied cognition, Game systems and design, Game play, Interaction

1. INTRODUCTION

Games are something that people play, and computer games are designed to be played – or interacted with. Many modern games involve the simulation and representation of a virtual environment (cf. Aarseth [1]), and these games are the focus of the following discussion. I start by giving an outline of computer games as designed systems, and I discuss the fact that game interaction is an activity that demands player competences that are both cognitive and embodied. I then argue that since many new games incorporating virtual environments utilize simulation of a physical world much like the real one, we should not try to describe this part of games as based on rules – be it a game rules or some other kind. Instead I propose that we acknowledge that certain relationships in game worlds are better understood as being governed by the simulation of laws, that we interact with these on the basis of embodied skills, and that Ludus rules in computer games should be understood as something that is often applied "on top of" a simulation structure.

2. ANALYSIS OF COMPUTER GAMES

Starting with computer games in general, there have been several proposals within game studies as to how one can analyze a video game system structurally and/or formally. The introduction to Wolf and Perron [28] gives a brief overview of the different positions, summarizing the most relevant analytical categories as being those of "algorithm", "player activity", "interface" and "graphics". Konzack [21] has proposed a total game analysis framework consisting of seven layers; hardware, program code, functionality, game play, meaning, referentiality, and socio-culture. Aarseth (ibid.) has proposed a tripartite model, where game-play, game-structure and game-world are the three most relevant dimensions of game analysis. In the next sections I present a level-based model of the game as a functional system designed for interaction. I shall not make use of the exact terminology proposed by any one of the texts mentioned above, but the purpose will be to address many of the same issues.

2.1 The game as multi level system

The first relevant level is the *hardware.* This can be functionally defined as consisting of CPU, GPU, RAM, storage devices, buses and pipelines etc., allowing the framework to address different physical platforms under the same headings. Hardware works more or less directly together with the *code* level, often also referred to as the software layer. Since code runs on hardware, hardware considerations will be relevant to games analysis to a certain extent; the computational power inherent in a given hardware configuration combined with given code constrains design of and interaction with game systems. We will return to this in section 5. For the present purposes, the most significant part of the code level is the game code or game architecture. This is sometimes referred to as consisting of one or more engines; the game engine handles core mechanics of the game proper, the physics engine calculates so-called rigid body dynamics, while the graphics engine handles (certain) calculations and rendering of visual states. There is of course no straight divide between these, but it allows one to address specific functionality in the code layer.

Returning to the system of levels, the game code is responsible for the calculations of *game* level properties. Borrowing an important distinction from Dourish [6], there is a gap between the level at which the game is implemented by the system and the level at which it is abstractly realized. Here, implementation is the workings of code and hardware, while abstract realization is the game level. The latter is the realm of ludological entities: An analysis of the game level would yield information such as the rules of the game, the number of save games, number of lives and pause/non-pause states, and maybe also current objectives stipulated by the game in slightly abstract terms. I would also urge a distinction at the game level between a) game rules and b) the laws and relationships of the *game world* part of the game level; the latter contains characters, creatures and objects and their respective states, the state of the total simulated environment and the regularities pertaining to relationships between agents, objects and setting. The distinction between *non-diegetic* information states and *diegetic* game world, well known from both literary and audiovisual narratology (and applied to game studies by e.g. Wolf [29]), captures some of this distinction between game information and game world information. Juul [17] distinguishes between rules and fiction, which is also somewhat parallel to the present distinction between game and game world, but my view of the role of rules and laws differs from Juul's, as I shall elaborate in section 5. Finally, the *AVT-stream* level is the audiovisual-tactile stream of information that is being continually created by the system by feeding output signals to loudspeakers (audio), screen or projector (visual) and force feedback mechanisms in controllers (tactile). The game level and the AVT-stream are thus the primary parts of the system dealing with the simulation and representation of an environment that allows us to speak of a *Tomb Raider* game as involving “Lara moving through an Egyptian tomb” as opposed to, say, “thousands of variables manipulated over time by code running on a hardware platform”.

The separation of game code architecture and game as distinct levels allows us to analyze a given computer game as a large structure of code, which is a necessity if one wants to address the question of how the computer game system actually computes and/or simulates the regularities involved in the manipulation of entities on a different level of realization, such as characters and (simulated) physical properties of objects. We have to progress from the level of code or game architecture to the levels of game, game world and AVT-stream in order to find the entities and relationships we’re usually interested in when we seek to analyze games. Even though high level scripting languages might designate certain objects as “objects”, the actual computations (and the machine language responsible) cannot be said to deal directly with Game World entities such as e.g. intricate dwarven artifacts in *Elder Scrolls III: Morrowind* or personality and mood of NPCs in *GTA: SA*. It is only the latter entities that we usually experience as being the meaningful parts of any given game. It might seem a rather banal fact that the properties and regularities of the game and game world are highly distinct from their programming implementation, but this particular aspect of the implementation-abstraction gap has ramifications for the analysis of the relationships between design and player interaction (sections 3 and 4) and the rules/laws distinction (section 5)

Figure 1. The game system

3. INTERACTION

The concept of interaction is probably as polyvalent and multilayered as they come; overviews within media studies and game studies have been given by Jensen [15], Bruhn Jensen [3] and Klastrup [20]. Common to these definitions is a positing of a close relationship between interaction and communication, and since I would like to avoid this for the time being, I will start with a more general definition of interaction by stating that humans interact with the physical environment all the time. The following approach is inspired by the theory of *embodied cognition* as presented by Clark [4] and Kirsh [19], by the “skills and abilities” perspective of embodied interaction as it is employed by Dourish [6], and by the application of embodied cognitive theory to computer games analysis seen in Grodal [13]. The general idea is that activity and interaction depends upon cognitions tightly integrated with embodied activity in the physical world. Perception is seen as integrated in an action structure that tracks and reacts to sensori-motor regularities arising from the coupling of individual and environment. The regularities pertaining to this kind of general interaction are determined by factors related to both individual and environment, where the two constantly influence each other over time. In the present framework, the individual is a game player with motivations and a set of competences, the most important for the present purposes being cognitions (conceptual schemata) and embodied skills available for recruitment through intentions. The environment is here the combination of physical game system and simulated game world.

3.1 The question of the sociality of interaction

The following caveat might be in order at this point. The rest of the paper focuses on *individuals interacting with single player game media*. Sociologically inclined researchers of media and games would probably hold that an analysis of individuals involved in media consumption simply cannot be detached from an analysis of the social. This kind of reader would find support for such a standpoint in the works of the authors just cited for inspiration above: The aforementioned perspectives of Clark and Dourish both draw on ideas from distributed cognition and cognitive ethnography, and it is a major point of Dourishs’ approach to HCI that it seeks to engage the social aspects of this relationship. One of the key ideas of distributed cognition is that cognitive representations will often be distributed among more than one individual and that these individuals will unload both memory and computational strain onto artifacts in the environment. I will nevertheless focus on single person activities in the following and maintain my focus on the relationship with an environment that is physical rather than social. I am certainly not stating that the beliefs, desires and embodied skills of an individual are autonomous from structures best understood as social, I am merely bracketing these factors to focus on the relationship between the single player individual and the simulated, physical game world in a series of interaction events. The primary question is probably to what extent the social nature of reality and the distribution of cognition is invalidating the following idealized exposition. I will attempt to comment on this idealization of relationships as I go along, but my contention is that the primary explanatory power of the model is not invalidated by social factors and that it may be augmented as needed: I thus urge that the reader think in terms of compatibility with other ideas and frameworks instead of inadequacy of correspondence with “actual, messy social reality” – whatever the latter might turn out to be represented as in scientific discourse.

4. GAMES AS DESIGNED SYSTEMS

Moving on to systems as products of design, a general theory of design and interaction is offered by Donald A. Norman, who has dealt with both computer application design specifically [23] and design processes in general [24]. The following model draws on Norman's ideas of *conceptual models* and the distinction between the *system* and the *system image* as the two parts of a given designed system. The conceptual model is shorthand for how the user understands or conceptualizes a given design. The system is the total functional system, whereas the system image refers to only the visible part(s) of the system immediately available for information pick-up. Ontologically speaking, there is of course no way of designating a certain physical part of a system as not being a (potential) part of the system image, as e.g. engine hoods on cars should make evident. Also, the ability to see something as an indicator of system performance (and thus in some sense see it as part of the system image) varies between individuals – professionals can often tell things about systems that lay people are not able to see. The distinction between system and system image is, I think, first and foremost a pragmatic distinction supposed to highlight the fact that designers cannot depend on their users having technical or otherwise expert knowledge of things and their "insides": They have to design the system so that users can deduce how it works from appearance, the general principle being that information about the relevant system states should always be available. Also, this information should be presented in a manner that accords with the way humans tend to process information. Many modern devices incorporate a visual display in the system image; in the case of game systems, the primary part of the system image is the AVT-stream. The overall framework is outlined in figure 2.

4.1 The game system and user actions

In the case of game systems, the player interacts with the game system through a *control interface*, this being the only way to alter the game state. To ease the following piece of exposition, I will limit myself to the cases where the game world is seen through a virtual camera and traversed by the player by either an onscreen avatar (this being a 3rd-person view) and/or an "embodied" off-screen avatar (1st person view). The movement of avatar and camera is mapped to either a keyboard and mouse or a game control pad. The convention is that one can control the avatar and/or the camera with certain mappings; in the case of 1st person viewpoint, changing the camera means changing the avatars direction of facing (FPS-convention as in *Doom*, *Quake*, *Halo*, *Half-Life* and respective sequels), in other games the camera is movable independently of the avatar (e.g. action adventures such as *GTA*, *SW: KOTOR*, *Ninja Gaiden* and *Prince of Persia: SoT*). It is a general point of embodied cognitivism that perception is not passive but an activity integrated with the actions of the embodied subject. Perception is seen as an ongoing cycle of sampling, exploration and manipulative interaction between environment and the cognitions and skills of the person, cf. Neisser [22] and Gibson [12]. If we apply this to video game playing, we end up with an interesting link between perception and embodied skills: We usually don't have to think about moving e.g. our neck muscles and torso in order to get a better view or to check out something suddenly worthy of attention, but a change of viewpoint in a computer video game actually requires a mapping of that intent onto the control interface. This means that there is a kind of double intentional stream with regards to the perception and action cycle of computer video game play; both 1) the "normal" one that allows us to scan the environment with our eyes and ears and focus on certain aspects of reality and 2) the one that demands a mapped control action through the interface. A fascinating aspect of this is the fact that even though only one of these two streams have a direct causal impact on game state, I would contend that once the player "gets to grips with" the game – a process of actively acquiring a set of new embodied skills – this becomes a *single, unified intentional stream of action*: The expert player does not need to think about coordinating the change of viewpoint with a change in perceptual attention – he is simply actively exploring and manipulating the virtual environment. Another interesting fact is that player actions will usually be directed primarily at manipulating game level properties, but the player might draw on knowledge of how the other levels of the system influence the game level; developer console modes, cheat codes, cartridges and downloadable mods etc. are used by (in certain cases expert) players of single player games; server lag and other hardware related issues are sometimes exploited in multiplayer games. The way in which these multilevel operations are incorporated into the structure of action probably varies, but my intuition would be that the idea of unified action still applies to many expert players.

4.2 Action and information

User actions can be said to have a "feed-forward" direction of causality working from user intention to changes in system state; however, seen from the system end, a continual stream of information is also being "fed forward" in the opposite direction from the system via the AVT-stream to the user. Users will often have a high level goal and take action on a lower level in order to attain this goal – the set of lower level actions that can satisfy this will often, but not always, be quite varied (e.g. the different ways of making a sandwich, getting to a specific place or leveling a character in a RPG). In Norman's terms, the system image is supposed to reflect changes in the current system state by giving adequate *feedback* about the changes resulting from a given action. Every time a user takes action towards the artifact, s/he will be looking for information feedback[1], and the adequacy of a given design is directly tied to how effectively the system image yields information (gives feedback) about the system state: Insufficient or arbitrary feedback leaves the user not knowing whether further action is required to bring about the goal. It should be clear that this information about system state has to be experienced as having some pertinence in relation to the high level goal – which is another way of saying that system states are meaningless without a minimal understanding of functionality: "What does that sound mean?"; "How does this aspect of system change help me reach my goal?" It will also be very important to the player to have access to information about various system states that are not direct results of actions but still pertinent to the current goals of the player. Almost all computer games with virtual environments generate events independent of user control: Event generation is perhaps the fundamental trait of a computer game system. The abstractly realized representations of the simulation of various physical processes and agencies might or might not be directly caused by the player but they can still be highly relevant to player concerns. Considering the fact that the AVT-stream in theory carries information about hundreds of corresponding properties of both game and game world and feed-forward of AVT-information is constant, the user is prone to look specifically for information in accordance with the current structure of actions related to goals. What just happened after I pushed button X? What could be relevant to my current goals? What could change my goal?

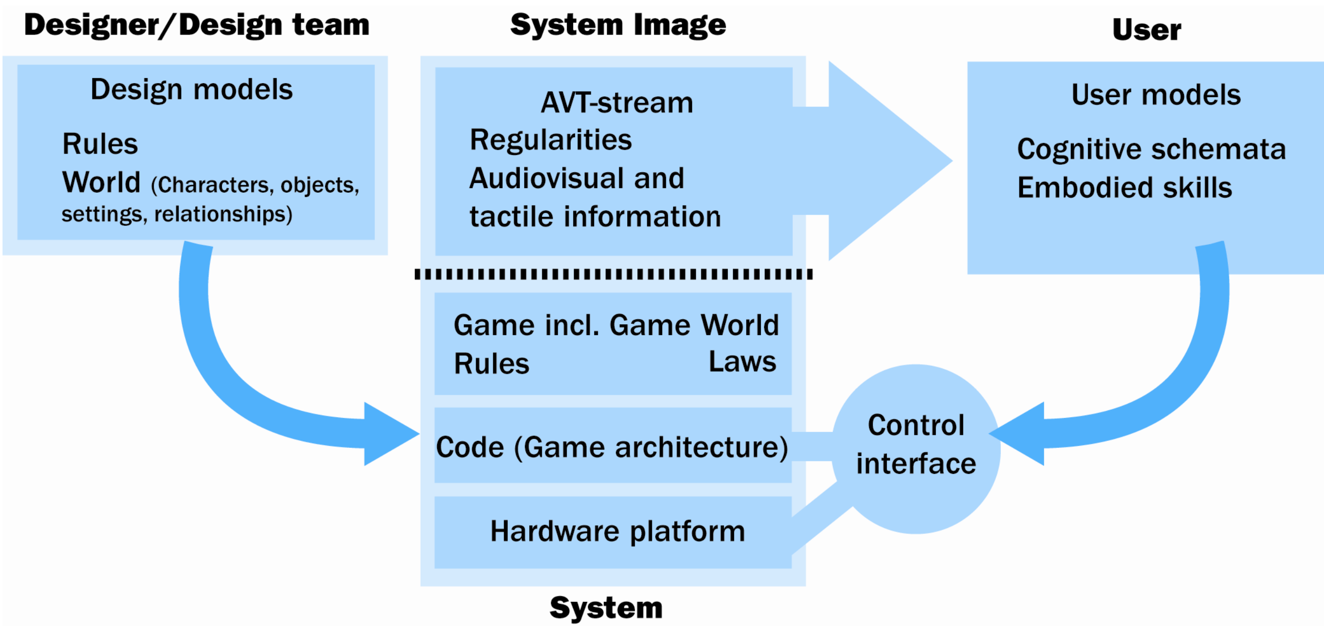

Figure 2. Designer, system and user

Following the above, the well designed game system is set up to primarily deliver two kinds of information through the AVT-stream; both feedback to immediate actions and the relevant "feed forward" of information that is involved in the current game play. Another way of phrasing this would be that game systems in single player games often need to "predict" what kind of information is needed at any given moment. Also worth noting is the fact that these notions of relevant information and player influence are codependent and tied to player concerns and motivation; an actual interaction episode cannot be analyzed by just looking at the AVT-stream without taking into account current player goals.

4.3 The embodied competences of the player

As can be seen in figure 2, following both Norman and general consensus within embodied cognition, the player has to rely solely on her/his competences and knowledge of the game system when interacting with the system. By interacting with the game system, players effectively change their models of the game and their embodied skills: They learn new facts about the game rules, they learn to track an increasing amount of the regularities of the game world and they learn to master the controls needed to traverse the universe in question. The embodied knowledge of the player – his/her game competence, one might call it – is constantly developed by interacting. Since the only source of knowledge about the current state of affairs is the system image (i.e. the AVT-stream), this is the primary input to updating the user's models. Even though the unified action stream might draw on multilevel knowledge, the average player does not have any real access to hardware states, software states nor the design models of the design team. As mentioned above, everything in the interface in some way carries information about the game world state. From the perspective of the designer, it is vital that the system is set up in such a way that information relevant to the rules and simulations of the underlying game mechanics are being reflected in an adequate way. These display regularities govern the multitude of ways in which the AVT-interface reflects the game and game world states, and they are absolutely central to user interaction, since the user only has access to the game and its current state through the interface: Whether "it's in the game" or not, if it's not "in the interface", no one will know it's in the game.

There is an important exception to the abovementioned relation between system, system image and user models. As Norman points out, most appliances come with instructions, but his (clearly normative) point is that any appliance should be self explanatory, i.e. usable with only a minimal user need for documentation (obviously, this "no manual" attitude may or may not be part of the design philosophy of a given game). Most games do come with manuals, and these are usually a vital resource for building an initially valid conceptual user model, but the main point here is that since games are played by other players, one can usually consult other sources in order to update, correct or augment one's conceptual model of a given game. Anyone with an internet connection can access vast amounts of walkthroughs, hints, forum posts and even media files dealing with the intricacies of popular games. Naturally, this primarily applies to the *cognitive* aspects of the mental modeling: Very few players would be able to read themselves to a complete understanding of the control of human avatars and vehicles in games (also see section 5 and 6 below), since this is very much dependent on embodied skills. The requisite skills of e.g. visuo-motor coordination required by some games may be quite demanding; even though a player "knows what to do" s/he might not be able to do it at all – *Ninja Gaiden* comes immediately to mind to this casual console player. This is in line with the intuitive notion that cognitive schemas are more immediately flexible than embodied skills – paraphrasing Dreyfus and Dreyfus [8] there is a big difference between *knowing that* and *knowing how*.

4.4 Model and implied players

Summarizing this far: Design processes incorporate designers working from design models; this leads to a designed system incorporating a system image; interaction with this system is a progressive embodiment of conceptual models and skills on the part of the player. One way to characterize this interaction is the idea of *embodied cognitive construction as reconstruction*[2]: The claim is that part of what is being progressively reconstructed through interaction is in fact the players own version of the design intentions that went into the game design process. By partial reconstruction I do not mean that some parts of the player experience is completely identical to design intentions while others may vary. Partial reconstruction is similar to posited design models because design constrains player behavior; the designed structure causes a degree of similarity with preconceived design ideas. However, since the player is interacting with the system exhibiting its own regularities, there will be many aspects of game functionality that are not intentional in a design sense. This goes for bugs as well as the many documented instances of "emergent" regularities of game worlds (see Juul [16]), many of which are better thought of as unintentional by-products of the design process.

The claim is simply that designers often think about users and their competences when designing artifacts – this would seem to be the basic idea of user-centered design. The viewpoint is, in capsule form, that *any artifact can be said to entail or presuppose its user as a consequence of its structure, and designers work from this assumption when designing game systems*. The structure of an artifact stipulates certain conditions that have to be met in certain ways in order for interaction to happen: Model and implied players are ways of stating these in abstractly anthropomorphic terms[3]. The *model player* is a gestalt – consisting of a set of competences – invoked by a designer or a design team in order to gauge the probable interaction structure of a coupling between a set of actual, real players and the current game functionality. In comparison, the *implied player* is the set of competences presupposed by the actual, current structure of the game system; this is an abstraction based on the game system structure, not the conceptual model of the designer and not actual player behavior. In a design process, these two player gestalts can be said to operate both implicitly and explicitly. Implicitly, the structure of a game always presupposes certain skills on the part of the user, whether designers think about it or not; the implied player is thus always there. But this implication can be "extracted" from a given structure at any given juncture of the design process. This gestalt can be compared to the intentions (i.e. model players) of the design team – noting that these designer intentions may vary considerately in form and degrees of concreteness. Any design process can thus make use of model player and implied players as explicit constructs; the designers can use this hypothetical coupling to either change actual game structure or to change their model player assumptions – or both. This is essentially a reflexive stance. Turning to an actual game play episode, the implied player is the "demand" in terms of player competences invoked by the systems current configuration. On this view, good progressive structure means a kind of parity between implied and actual player, bearing in mind that the appeal of games is often a certain level of challenge (see e.g. Salen and Zimmermann [ibid] , Juul [ibid.] and Csikszentmihalyi [5]

The present approach should be directly compatible with approaches such as the one proposed by Bartle [2] (see also Taylor [27]), where players have different motivations for playing. Transposed to the current framework, this would mean that these different playing styles based on motivation probably go hand in hand with embodied skills and progressive structure – one is apt to enjoy what one is already proficient at, or at least has a chance to learn. One can furthermore treat the four categories as styles that may or may not be tied to the same individual in a given situation, and look at how different design decisions affect play and embodied reconstruction: Most single player games seem to vary their different segments and levels so that they demand different playing styles within the same game (e.g. The "Halo"-level vs. the "Library"-level in *Halo*). A single game might facilitate one playing style only, but it might also facilitate different playing styles within the same environment, where segments of the game can be played for achievement and/or for exploration (e.g. the *GTA* series and *Morrowind*, see below). Players with a consistent motivation for playing in a certain style might try to work against the implied player structure in a given game, try to configure the system in a way that suits them or simply pick up another game.

5. RULES OR LAWS?

Within game studies quite a few scholars (most notably Salen and Zimmermann (hereafter S & Z) [25] and Juul [17]) hold that games should be studied as systems of rules, in accordance with the canonical work of Johan Huizinga and Roger Caillois. S & Z offer a comprehensive framework for both game design and game analysis, and while I agree that the perspective of rules is helpful in addressing issues of both design and gameplay in computer video games, I find the ludologists' rather eclectic use of the concept rules problematic. In terms of the present framework, the design models cognized by the designer(s), the rules and laws of the game system, and the rules and regularities observed and cognized by the computer game player are interrelated, but sometimes quite different things.

First off, there is the case of games vs. computer games. I take it that "classic" games such as Chess, Tic-tac-toe and Monopoly can be described fully by listing the rules: But these are limit cases and pose problems when it comes to computer games. An important distinction here is between what is possible and what is allowed. In the case of classical games, we can list (a specific variation) of the rules of the game, and one of the primary functions of these rules is to delineate what counts as valid actions and states and what is not allowed in the game context. Chess rules stipulate that players cannot legitimately move the rook diagonally, but in a setting of actual, physical chess playing, nothing prevents a player from actually doing it – it won't be recognized as a valid move, but the actual action of moving the piece is possible. This is because the physical setup of the game and the natural laws of our universe do not make much of a difference in chess – chess is all about the rules. This changes when it comes to almost any sport. All ball games utilize explicit rules, while implicitly exploiting constraining facts about the physical world and the anatomy of humans, as also pointed out by

Juul [ibid.]. All game rules take certain physical and biological constraints for granted: It would clearly be pointless for both game and sports rules to deal with activities that are impossible to perform. One of the key functions of game rule sets is rather to stipulate both what is not allowed and the consequences in case players do something forbidden.

The distinction between simulation of (often physical) relationships and game rules is well known by researchers within the field – the simulation ludology proposed by Frasca [10, 11] distinguishes between paidea and ludus, S & Z [ibid.] distinguishes between three kinds of rules, Juul [ibid.] distinguishes between different rules governing fiction and game – but the terminology used in all places is still "rules". One of the problems is that the term rules is used to designate certain structures and relationships that can be adequately couched in propositional terms, but they are also used to try and grasp something which simply cannot. It is also applied to relationships that are or can be potentially acknowledged by individuals as rules, and to relationships that cannot. I take it as a defining characteristic of a rule that it is actually possible to state the rule in natural language, but I would also like to hang on to the idea that *game* rules are fundamentally conventions: Players are supposed to understand, acknowledge and follow these rules, as emphasized by both Caillois and Huizinga. Following this, a modern game world is governed by mechanics that I would rather call simulated laws, since they do not regulate what is allowed but rather what is *possible* in that universe. Non-acknowledgement or violation within the simulated environment is impossible, since there is no way to defect from game mechanics (such as e.g. D20) or simulated physics, short of rearranging the system code or stopping play.

This mechanically given and non-negotiable character of certain computer game relationships is acknowledged by the four authors (Frasca, S & Z and Juul) in slightly different ways. Frasca's Paidea-Ludus distinction is co-opted from Caillois and is meant to distinguish between two kinds of activities (play and game), which means that computer games can be placed in a continuum between these two poles, since they usually imply both to varying degrees. Frasca also maintains that both kinds of activities are governed by rules; the principal difference is that Ludus implies victory or defeat conditions, whereas Paidea does not. I may be reading him wrong, but it sometimes seems that Frasca means that simulations fall into the first category, and classical games into the second, but I think that is not quite true, as I will elaborate below. S & Z's view is that "rules limit player action", but one could ask both Frasca and S & Z if everything that limits player action has to be a rule? Could it not be, say, simulated laws implementing a certain relationship with certain higher order features (e.g. hills or rigid structures) in the simulated landscape? S & Z use an example from *Thief* in order to differentiate between what is included in the rules and what is just "part of the game world". The *Thief* games are "First Person Sneaker" games where the primary objective is to stay quiet and unseen (as opposed to the all-out mayhem of many FP-Shooters). S & Z's view is that since the differently rendered surfaces in the game world produce different sounds when interacted with, these relationships are part of the rule structure. My view is rather that many modern computer games are a lot like real life sports: They apply rules "on top of" laws, but in computer games, the presupposed structure of law-like constraints is simulated. Computer games simulate certain relationships and Ludus rules are (or can be) applied to work with these. In the *Thief* example, neither the sounds nor the relationship are part of a rule structure but rather the result of a simulated interaction of different materials and such a simulation of specific relations can be exploited by different Ludus rules in different ways. A similar (but simpler) simulation mechanic is found in *Halo*, where the sound of the avatars footsteps also change according to certain floor materials – but in *Halo* this is not used in the calculation of enemy AI at all. One might say that the games have similar simulation layers but different rules (see the analysis of *GTA: SA* below).

Juul's stance is somewhat different. He points out that some video games (e.g. soccer games) have to implement some kind of simulation of the laws of physics as well as the game rules, but since both depend on computation, Juul states that this simulation is implemented "*on the same level as the explicit rules of the game*", and he goes so far as stating that "*everything that governs the dynamical aspect of a game is a rule*" [ibid., emphasis in orig. both places]. The first sentence is true in the sense that code can be said to implement everything in computer games and it is worth emphasising that lawful relations in computer games and game worlds are always due to the workings of code and hardware. But Juul's second statement seems much more problematic and does not follow from the first. Simulation is the basis for physical, dynamic relations in the game world, but this is usually realized by massive amounts of algorithms incorporating functions involving differentials, constants and variables etc. I find it counterproductive to use the term "rules" about such mathematical algorithms. I also doubt that the average games analyst would be able state any of them when faced with a given computer game.

I do agree that there is explanatory power in analyzing a certain aspect of computer games as structures of rules akin to the classical sense, but I also think that when one extends the explanatory domain to "everything that governs dynamics" the status of these rules become questionable. Furthermore, the move from design to analysis is from stipulation to explanation, which means that all the usual problems apply when one tries to describe regularities; e.g. is a given rule expressed as suitably abstract, under what conditions does it hold, is it general enough to cover all relevant cases, how do we know that X is really a result of Y, and not caused by Z which correlates with Y, etc.? If you add the problems concerning multiple realizations in computational systems, it seems to me that games analysts have a very slim chance indeed of describing any actual "rules" governing the simulation layer in any modern game incorporating simulation of physics or A.I.

We might also ask the question of whether player behaviour depends on rules, and if yes, what kinds? If one believes in rule governed behavior at all, there is no principled reason to exclude computer game players. Since I believe that the structure of artefacts constrain user behavior, I think that certain aspects of player behavior can be described in terms of rules –but if we want to uncover these rules of playful interaction, a better candidate than game rules would be those of psychology and social science (the usual problems (some of which are mentioned above) would of course still apply, now with respect to people instead of game systems). We might also ask whether players *cognize* game rules in a conscious manner. Some of the time it certainly seems like it, e.g. when they act according to game rules, try to meet victory conditions and/or goals etc. But do they also cognize the simulated world as being governed by rules? Probably not as much as they do not: As Dreyfus and Dreyfus [ibid.] note, rules are often used as a supplement to embodied skills, but a skillful performance can very seldom be described in rules by the skilled person. Players can make use of "rules-of-thumb" such as "do not brake and steer at the same time" when they enter a curve in a driving game, but such rules are only helpful up to certain point; after which the situation is a lot more like driving a (real) car or catching a thrown ball. Your body has to learn how to do it.

Sophisticated simulation of physics and AI is of course not manifest in all games, but as computer systems get more and more advanced, the previously impossible simulation of both realistic physics and quasi-sentient behavior is rapidly becoming an integrated part of the simulated virtual environments of computer games. The fact that a computer game universe is computationally simulated and thus of a mechanistic nature that can be altered in a multitude of ways is not really an issue here, since the regularities in question simply don't take the form of game rules – what are the rules of throwing crates or cars around or the rules of the guards' behavior in *Half Life 2* and what rules govern the benefits obtained by purchasing a new intake and exhaust combo in a racing simulator/game such as *Forza Motorsport*? It is plausibly a game rule of *Project Gotham Racing 2* that you lose your kudos (score points) if you crash into stuff, but in order to actually "obey" this rule, you have to use your embodied skills to track and react to the variables associated with the track, the speed and handling characteristics of the car, etc. The actual computation responsible for this simulation may or not be based on rules (e.g. it can be connectionist, utilize probabilistic algorithms etc.), or it might be rule based but utilize completely different rules from those that players and analyzers posit. The interesting thing is that if we look at the player, it doesn't really matter how the simulation of physical relationships is implemented in the code layer – *a very significant aspect of interacting with virtual worlds is not based on cognizing rules or other linguistic constructions.* These aspects of virtual worlds are grasped and reacted to as regularities by the embodied player, just as similar relationships in the real world.

6. SAMPLE GAME ANALYSIS

The single player campaign in *Halo* is a good example of a gradual expansion of the set of conceptual models and embodied skills needed to complete the different levels. The singleplayer campaign also functions as a tutorial for players to gain rudimentary skills to be able to enjoy the multiplayer functionalities of the game – although, interestingly, some of these concepts and skills will have to be partially unlearned and restructured once one starts playing with and against other human players. The first level of the single player campaign introduces you to moving the avatar on foot and the rudimentary combat mechanics. On the second level one gets the opportunity to control the Warthog, which means the player has to expand his/her embodied set of skills and juggle two modes of control. Vehicle driving is especially sensitive to immediate feedback in order for the player to accurately gauge the amount of manipulation needed; variables such as traction and speed need to be gauged from the transformations of the system image, and *Halo*, as is now customary, utilizes all three channels of the AVT-stream for this purpose. As already mentioned, these relationships of vehicle speed and traction are not expressible in rules, but the regularities are easily interacted with through embodied motor skills. Later, the game introduces the Flood, and the player has to augment his competences even further when s/he has to juggle the skills necessary to neutralize several types of enemies with quite different attack patterns. Also, a cognitive (and possibly emotional) reversal occurs when the player learns that s/he has been cheated into helping a robot guardian whose real plan is not to help the avatar but rather to destroy all life in the galaxy. This simultaneously restructures the relationships between the entities in the game world by making an enemy of a former ally, demanding that the player learns to avoid or neutralize the formerly friendly robots. Another noteworthy fact about Halo (and its sequel) is the way users have been toying with the idiosyncrasies of the physics engine in order to toss about Warthogs, tanks and other things in ways that completely defy the normal laws of gravity. This is clearly not designed, but a by-product of a designed structure.

In *GTA: SA*, the player is also being gradually introduced to the mechanics and laws of both the game rules and the game world by a carefully designed progression structure. Progressing through the first missions, you are given specific goals in the game world while the non-diegetic interface distributes goal-pertinent information about how to ride vehicles, climb fences and walls ("press button X to do Y", etc), about game rules (consequences of hospitalization etc.). It also offers up the current objective if you seem to linger. This is both an augmentation of conceptual knowledge of the game rules, of the world of San Andreas and an "invitation" to increase your skills in order to explore and achieve at the same time. These invitations cannot be overheard consistently if one wants to interact with the environment. Since the environment is essentially hostile, the virtual world of San Andreas cannot be explored in full without mastering the controls of avatar movement and of the various aggressive actions. A large part of mastering the game consists of learning to control the different vehicles, and since these utilize the simulated physics of the game in different ways, it calls for embodied skills of a quite sophisticated nature. The difference between simulation laws and game rules is visible in the way the "mission" mechanic of the game works. The various missions all stipulate an overall goal and sketch out the requisite success conditions, and these are superimposed on the same simulated environment. The game world is in this way repeatedly recruited in different ways by differing rule structures to form the basics of smaller game systems. *GTA: SA* is a multitude of games set in a virtual, simulated world.

I am not proposing a neat separation of rules-laws and game-game world here; As noted by Juul [ibid.] the *GTA* games exhibit a wide range of mildly curious overlaps between game rules and game world, (e.g. the many red "objective" markers and the large "Save Game" disk that sits quietly spinning in Carl's kitchen in *GTA: SA*) This question of clashing explanatory levels is too complex to go into here, but I would suggest that the dichotomy Juul calls "rules vs. fiction" could just as fruitfully be construed as being between game rules ("Three strikes, you're out!" and game world laws ("Mario has been reincarnated!").

The *GTA* series has been hailed as being open-ended and well suited for both goal-related and explorative player behavior – I have just mentioned how this is related to its combination of simulation and rules. On the subject of exploration, Aarseth [1] tells us how he happily explored the notoriously open-ended

Elder Scrolls III: Morrowind and completely missed a central feature of the game, until he consulted a walkthrough. His consultancy resulted in an "overdose" of implied player structure and resulting disappointment when he became aware of the fact that the game actually has a carefully designed central series of quests that the player is supposed to accept. This series of quests has a delicately balanced storyline in which you gradually learn more about the individuals and institutions in the game world. This is obviously designed to gradually drag the player into an epic story of political intrigue and power struggles involving the players avatar, the indigenous population, the occupying Empirial forces and eventually a couple of the local deities. One of the main differences between *Morrowind* and many other games is that it doesn't force you into this specific gradual development cycle. *Morrowind*'s design does however necessitate that the player adopts an achieving playing style in order to explore, since – as is the case with *GTA: SA* and several other games – many areas are simply off limits to low level characters. The many ways one can "achieve" in the game is however an impressive design feat. And a little note on feedback: *Morrowind* did not originally feature a way of knowing how close to death an opponent was. This was clearly a design decision, but one unpopular in the gaming community, so the latter, patched version features a yellow bar showing the health status of the enemy currently engaged.

7. CONCLUSION

I have sketched out a model of the game system as a product of design models and given suggestions to how one can understand player interaction with the game system. Lodged within the framework are at least two more general, one of them admittedly polemical, points.

The first is the idea of understanding design as an intentional reconstruction process. To researchers coming from an aesthetic tradition, this may seem to imply a version of the intentional fallacy, but my position is not the one advocated by Humpty Dumpty in Lewis Carroll's classic tale, i.e. that whatever one intends with an utterance is what it means. I merely state the rather basic assumption that cultural artifacts such as games are designed systems. This means that the people behind the design had some specific ideas about the effects on the end user. The framework addresses the point of varied consumption by acknowledging that players are free to do whatever they want with games – however, it is my contention that a substantial portion of them enjoy doing what the designers meant them to do, i.e. experience a pre-structured relationship with a relatively open but still goal-related design structure. As far as I can see, the concept of reconstruction is in no way invalidated by (the claims of scholars who describe) players that seek to interpret, recontextualize, undermine or otherwise go against what seems to be designed features, neither does it exclude the enjoyment and/or exploitation of regularities that are clearly non-intentional. It simply points out that play may be following a set course much of the time.

But even if preset courses are followed, the behavior need not be rule based: The second point – my "attack" on rules – is both an attempt to curb the use of rules as a blanket term for game analysis and a call for further discussion. Even though I personally don't accept the many uses of the term rules, the design stance of the proposed framework is otherwise compatible with academic but practical design approaches such as the one proposed by Salen and Zimmerman and with many of the analytical insights of both Juul and Frasca. I propose that we consider the adoption of simulation laws (as in natural laws) as opposed to the almost ubiquitous use of rules as a descriptive and explanatory entity. The primary virtue of the "simulation laws" argument is that we get to distinguish between a) computationally simulated relationships between physical entities in the game world and b) Ludus rules that govern goals and valorization of outcome. It also lets us acknowledge the existence of computational, mechanistic relationships in games with which we are perfectly able to interact with because of our embodied abilities, and not because we "understand and/or follow the rules of the game". Many of the simulated laws are just like the ones in our normal environment, and we are able to react to them in much the same way. Our embodied understanding of our everyday environment can often not be described as rule governed – and we should stop thinking that this is possible when it comes to computer game playing. Parts of this kind of interaction are not captured very well by game studies rule lingo, but an alternative, albeit rudimentary, definition might go something like the following, where ecological psychology, embodied cognition, phenomenology and psychology of perception, attention and action could be used to further augment the framework:

The interaction with and feeling of a given virtual environment is directly dependent on the regularities exhibited by the representation of this environment when the user interacts with the system. This relationship can be understood as one involving represented regularities arising from both the simulation of laws and the implementation of rules and a player tracking and reacting to these through cognitions and embodied skills.

While games like Tic-Tac-Toe can be reductively explained by rules expressed in a natural language (perhaps with a bit of logic on the side), this is simply not the case with virtual environments. So, regarding gameplay and rules, how about trying something else for a change?

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[1] This concept of feedback should not be confused with the feedback concept of cybernetics or systems theory where negative or positive feedback regulates the system towards or away from equilibrium.

[2] For a related, but slightly different view of the idea of understanding design as reconstruction of intentions, see Suchman [26]

[3] This idea has its parallels within literary theory, as Eco [9] and Iser [14] has used such concepts as model readers and implied readers. The concept of model player has been noted *en passant* by Frasca [10], and Järvinen [18] has mentioned the implied player, but in order to apply these two useful concepts in a game study context, I think we absolutely need to emphasize the fact that – in contrast to "readers" – these players are not meant to model or imply a specifically literary or linguistic competence nor a specifically aesthetic experience: Game interaction is embodied and not solely linguistic and it does not usually have the hallmarks of reflexive, aesthetic appreciation but rather of pragmatic interaction.